IN THE SPECIFICATION

Page 1, before the first line, add the following paragraph:

This is a continuation application of U.S. Serial No. 10/405,645, filed on April 3, 2003, which is a continuation application of U.S. Serial No. 10/095,581, filed March 13, 2002, which is a continuation application of U.S. Serial No. 09/468,327, filed on December 21, 1999, now U.S. Patent No. 6,542,961. This application is related to U.S. Serial No. 10/095,578, filed March 13, 2002.

Pages 4 and 5, the paragraph bridging these pages from page 4, line 18 to page 5, line 4, the marked up paragraph is as follows:

The disk storage system of this invention contains a storage device having a record medium for holding the data, a plurality of storage sub-systems having a controller for controlling the storage device, a first interface node coupled to a computer using the data stored in the plurality of storage sub-systems, a plurality of second interface nodes connected to any or one of the storage sub-systems, a ~~switching means~~ switch connecting between a first interface node and a plurality of second interface nodes to perform frame transfer between a first interface node and a plurality

of second interface nodes based on node address information added to the frame.

Page 5, the first full paragraph (lines 5-18), the marked up paragraph is as follows:

The first interface node preferably has a configuration table to store structural information for the memory storage system and a processing unit to analyze the applicable frame in response to the frame sent from the computer, converts information relating to the transfer destination of that frame based on structural information held in the configuration table, and transfers that frame to the ~~switching means~~ switch. Further, when transmitting a frame, the first interface node adds the node address information about the node that must receive the frame, to that frame. A second interface node then removes the node address information from the frame that was received, recreates the frame and transfers that frame to the desired storage sub-system.

Page 5, the second full paragraph (lines 19-25), the marked up paragraph is as follows:

In the embodiment of this invention, the disk storage system has a managing processor connecting to the ~~switching~~

~~means~~ switch. The managing processor sets the structural information in the configuration table of each node according to the operator's instructions. Information for limiting access from the computer is contained in this structural information.

Page 6, the first full paragraph (lines 1-8), the marked up paragraph is as follows:

In another embodiment of this invention, the first interface node replies to the command frame sent from the computer instructing the writing of data, makes copies of that command frame and the following data frames, adds different nodes address information to each frame so the received frame and the copied command frames will be sent to the different respective nodes and sends these frames to the ~~switching means~~ switch.

Pages 13 and 14, the paragraph bridging these pages from page 13, line 3 to page 14, line 5, the marked up paragraph is as follows:

Figure 5 is a block diagram showing the structure of the host I/F node 203. In this embodiment, use of a fiber channel is assumed for both the diskarray I/F21 and the host I/F31 in

order to provide a specific description. The host I/F31 and the diskarray I/F21 can of course be implemented with interfaces other than fiber channels. By utilizing an identical interface, the host I/F node 203 and the diskarray I/F node 202 can both have the same structure. In this embodiment, the diskarray I/F node 202 has the same structure as the host I/F node 203 as shown in the figure. Hereafter, the host I/F node 203 will be described by using an example. A Searching Processor (SP) searches for what frame to connect the fiber channel frame (hereafter simply called frame) to, an Interface Controller (IC) 2023 transmits and receives the frames with the host 30 (the diskarray subset 10 when using the diskarray I/F node 202), a Switching Controller (SC) 2022 performs conversion based on results found by the SP2021 for frames received by the IC2023, a Switching Packet Generator (SPG) 2024 packetizes the frame converted by the SC2021 into a configuration that can pass the crossbar switch 201 to transfer to other nodes, a Frame Buffer (FB) 2025 temporarily stores the received frame, an Exchange Table (ET) 2026 supervises use of exchange numbers for identifying a plurality of frame strings corresponding to a disk access request command (hereafter simply called command) from one host, and a

Diskarray Configuration Table (DCT) 2027 stores structural information for a plurality of diskarray subsets 10.

Pages 20 and 21, the paragraph bridging these pages from page 20, line 3 to page 21, line 5, the marked up paragraph is as follows:

Figure 7 is a diagram of the frame for the fiber channel. A frame 40 of the fiber channel has an SOF (Start Of Frame) showing the beginning portion of the frame, a frame header 401, a frame payload 402 which is a segment storing data for transfer, a CRC (Cyclic Redundancy Check) 403 which is a bit error detection code, and a EOF (End Of Frame) showing the end of the frame. The frame header 401 has the structure shown in Fig. 8. The ID of the frame transfer originator (S_ID), the ID for the frame transfer destination (D_ID), Exchange IDs respectively specified by the Exchange Originator and the Exchange Responder (OX_ID, RX_ID), and the Sequence ID for specifying the frame group within the exchange (SEQ_ID) are all stored in the frame header 401. In this embodiment, the ID assigned as S_ID to the host 30 in the frame issued from the host 30 are also used as the ID assigned to the port of the diskarray switch 20 as the D_ID. One pair of Exchange ID (OX_ID, RX_ID) are assigned for one host command. When a

plurality of data frames must be issued for the same Exchange, then an identical SEQ_ID is assigned to all of these data frames, and each one is identified as Sequence Count (SEQ_CNT). The Frame Payload 402 has a maximum length of ~~2110~~ 2112 byte and the contents stored in each type frame are different. In the case for instance of FCP_CMD frame related later on, the Logical Unit Number (LUN) of the SCSI and the Command Description Block (CDB) are stored as shown in Fig. 9. The CDB contains the command bytes required to access the disk (diskarray), the transfer start logic address (LBA) and the transfer length (LEN).

Page 36, the first full paragraph (lines 3-14), the marked up paragraph is as follows:

In this embodiment, to achieve total management of the diskarray system structure with the diskarray system configuration manager ~~(means)~~ 70, a diskarray management table (hereafter this table is called DCT, is provided in the diskarray system configuration manager ~~(means)~~ 70. The DCT comprising the diskarray system configuration manager ~~(means)~~ 70 consists of a group of two tables; a Diskarray System Configuration Table 20270 and a Diskarray Subset Configuration Table 202720-202723. The host-LU in this embodiment are all

comprise as one LU so that the "LU Type" in the Host-LU-Configuration table 20271 are all "ILU", and the "CLU Class" and CLU Stripe Size" are not significant.

Pages 36 and 37, the paragraph bridging these pages from page 36, line 15 to page 37, line 6, the marked up paragraph is as follows:

The administrator operates the management console 5, communicates with the diskarray system configuration manager ~~(means)~~ 70 and acquires information such as the number of disk units, and disk capacity of the diskarray subset 10, and performs setting of the LU110 of the diskarray subset 10 and setting of the RAID level. Next, the administrator communicates with the diskarray system configuration manager ~~(means)~~ 70 from the management console 5, controls the diskarray switch 20 and sets related information among the host 30 and the diskarray subsets 10. This operation establishes the structure of the diskarray system 1 and allows LU1 to be seen as the administrator wishes, from the host 30. The diskarray system configuration manager ~~(means)~~ 70 saves the above setting information, verifies the configuration according operation by the administrator and performs changes in the structure (configuration).

Page 38, the first full paragraph (lines 3-12), the marked up paragraph is as follows:

Figure ~~17~~ 16 is a block diagram of the IC (Interface Controller) 2023 inside the host I/F node ~~302~~ 203, when the host I/F is parallel SCSI. An SCSI protocol controller (SPC) 20230 performs the protocol control of the parallel SCSI. A fiber channel protocol controller (FPC) 20233 performs control of the fiber channel. A protocol exchanging processor (PEP) 20231 converts the protocol of the serial SCSI of the fiber channel and the parallel SCSI. A buffer (BUF) 20232 temporarily stores the data of the protocol being converted.

Page 40, the first full paragraph (lines 5-24), the marked up paragraph is as follows:

A method for configuration management of the diskarray system 1 is described using the fifth embodiment. Figure ~~18~~ 17 is a system diagram of this embodiment. A total of four host 30 units are provided in this embodiment. The I/F 30 connecting between the host "#0", "#1" and the diskarray system 1 is a fiber channel, the host "#2" and the diskarray system 1 are connected by a parallel SCSI (Ultra SCSI). The host "#3" and the diskarray system 1 are connected by a

parallel SCSI (Ultra2SCSI). The connection to the diskarray switch 20 of the parallel SCSI is performed in the same way as the fourth embodiment. The diskarray system 1 has four diskarray subsets 30. The diskarray subset "#0" has four independent LU. The diskarray subset "#1" has two independent LU. The diskarray subset "#2" and the diskarray subset "#3" are comprised of one combined LU (CLU). In this embodiment, just the same as the first embodiment, the diskarray subset 10 is concealed from the host 30, and the frame of the fiber channel is converted. The LUN assigned to each LU, in order from the diskarray subset "#0" are seven, LUN = 0, 1, 2, ... to 6.

Pages 41-43, the paragraph bridging these pages from page 41, line 1 to page 43, line 4, the marked up paragraph is as follows:

Figure 18 is a screen view showing on the management console screen 5. This figure shows the logical connection structure corresponding to the logical units (LU) and the host I/F 31. The logical connection configuration screen 50 shows the information 3100 relating to each host I/F 31, the information 11000 relating to each LU110, and the relation of the diskarray subset 10 and the Lu110. Information relating

to the host I/F 31 includes the I/F type, the I/F speed and status, etc. Information relating to the Lu110 such as the storage subset No, LUN, capacity, RAID level, status, and information are displayed. The administrator refers to this information and can easily manage the configuration of the diskarray system 1. The lines drawn between the host I/F and the LU on the logical connection configuration screen 50 shows the LU110 accessible by way of each of the host I/F 31. Those LU110 to which a line is not drawn from the host I/F cannot be accessed from the host 30 connected to that host I/F. The data configuration that is handled differs according to the host 30, and also differs according to the user so that appropriate restrictions on access must be provided in order to maintain security. The administrators setting the system thereupon utilize this screen, to implement restrictions on access by granting or denying access between the host I/F and each LU110. In the figure, the LU "#0" can be accessed from the host I/F "#0" and "#1" however, the LU "#0" cannot be accessed from the host I/F "#2" and "#3". The LU "#4" can only be accessed from the host I/F "#2". In order to implement these kind of access restrictions, the access restriction information is sent from the diskarray system configuration manager ~~(means)~~ 70 to the diskarray switch 20.

The access restriction information sent to the diskarray switch 20 is distributed to each host I/F node 203 and registered in the DCT2027 of each host I/F node 203. When an LU search check command has been issued for an LU with access restrictions, the host I/F node 203 performs a search of the DCT2027 and if a response is not obtained to the search command or if an error is returned, than that LU is no longer recognized (authorized) from the host. The Test Unit Ready command of the Inquiry command are not typically used when in the case of SCSI protocol as search command for the presence of an LU. Since read/write cannot be implemented without this search command, restrictions on access are easy to apply. In this embodiment, access restrictions are applied to each host I/F 31 however by extending this the implementing of access restrictions on each host 30 is easily accomplished. Further, the host I/F 31, host 30, or an address space can be specified, and access restrictions can be applied according to the type of command so that read only, write only, read and write permit, and read/write prohibit are enforced. In this case, the host I/F No, the host ID, the address space or the restriction command are specified as the access restriction information and the restriction set in the disk access switch 20.

Pages 50 and 51, the paragraph bridging these pages from page 50, line 8 to page 51, line 2, the marked up paragraph is as follows:

The following processing is implemented when an error occurs during frame transfer between the diskarray subset 10 and the diskarray switch 20. When the process being implemented is write processing, then a retry process is performed on the LU in which the error occurred. If the retry process is a success, then the process continues unchanged. However, when the retry process fails after a preset number of retries, then the diskarray switch 20 prohibits access to this diskarray set 10 (or LU) and information showing this prohibition is registered in the DCT2027. The diskarray switch 20 also reports this information to the diskarray system configuration manager ~~(means)~~ 70 by way of the communication controller 204 and the MP200. The diskarray system configuration manager ~~(means)~~ 70 then issues an alarm to the management console 5 in response to this report. The administrator can thus recognize that trouble has occurred. Afterwards, the diskarray switch 20 continues the operation by utilizing a normal diskarray subset. The host 30 also

continues processing without recognizing that an error has occurred.

Page 60, the first full paragraph (lines 3-25), the marked up paragraph is as follows:

Next, the setting of the alternative path is described, assuming that a problem has occurred and the path connecting the diskarray I/F21 to the host adapter "#1" of the diskarray subset 1 is broken or unusable as shown in Fig. 24. At this time, the host "#1" utilizing the diskarray I/F ~~2~~21 where the problem occurred, is unable to access the diskarray subset 10. The diskarray switch 20 detects an abnormality in the frame transfer with the diskarray subset 10 and when the path cannot be restored after retry processing is implemented, verifies a problem to have occurred on this path. When a problem occurs on the path, the SP2021 registers the information that a problem has occurred in the diskarray I/F "#1" in the DCT2027. Hereafter, the SC2022 of the host I/F node 203 functions to transfer frames from the host "#1" to the diskarray I/F node 202 connected to the diskarray I/F node "#0". The host adapter 101 of the diskarray subset 10 continues the processing of the command from the host "#1". The diskarray switch 20 reports the occurrence of a problem to the diskarray

system configuration manager ~~(means)~~ 70, and the occurrence of a problem is then reported to the administrator by means of the diskarray system configuration manager ~~(means)~~ 70.